

Outcome after supracricoid laryngectomies in the material of ENT Department, Poznan University of Medical Sciences

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Abstract All patients with T1 and T2 laryngeal cancer should be treated with the intent to preserve the larynx. In T3 glottic low-volume tumors, larynx preservation is an appropriate standard treatment option. Supracricoid partial laryngectomy remains a reasonable alternative to radiotherapy for patients with T2–T3 glottic cancer. Prospective clinical study aims to evaluate the oncological results of supracricoid partial laryngectomy as a treatment for selected glottic and supraglottic carcinoma, and to determine the different prognostic factors that may influence local control and survival. In the period of 2000–2007, 145 patients were treated at the academic tertiary referral medical center: ENT Department, University of Medical Sciences, Poznań, Poland. The ages of the analyzed group of patients ranged from 23 to 79, with mean 56.5 age for men and 25 for women. All of the patients had biopsy proven squamous cell carcinoma. Of the 145 patients 82 had glottic cancer and 63 had supraglottic cancer. The patients were staged according to the 2003 edition of the TNM classification established by the AJCC. The pathological TNM classification was additionally taken into consideration. All patients were treated by means of supracricoid and transglottic partial laryngectomy. The type of supracricoid partial laryngectomy was based on tumor localization and extension. Four patients underwent cricohyoidopexy, 57 cricohyoidoepiglottopexy, 65 reconstruction modo Calero, and 19 modo Sedlacek-Tucker. We performed 21 unilateral selective neck dissections and none bilateral. A nasogastric feeding tube was inserted in all patients, and removed in

patients that regained proper swallowing. As a result, we took into consideration the oncological and functional results. Histopathological examination of the operating specimen revealed the presence of dysplasia or invasive carcinoma at the margins, or a close margin of less than 5 mm from the edge of the resection (16 cases). The metastases were found on the neck in three cases, predominantly in the level II (2 cases) and III (1 case). Metastasis was found in one patient that had undergone CHP, Sedlacek-Tucker, and Calero, respectively. Five patients received postoperative radiotherapy. The decision to use adjuvant radiotherapy was based on the presence of invasive carcinoma at the resection margin and on the presence of multiple positive neck nodes or extracapsular spread of the disease. The Kaplan–Meier estimated 3- and 5-year overall survival rates in the group of 122 because 23 patients did not report for medical check-ups.

Keywords Reconstructive laryngectomy · Partial laryngectomy · Laryngeal cancer · Larynx preservation · Organ preservation

Introduction

All patients with T1 and T2 laryngeal cancer should be treated with the intent to preserve the larynx. In T3 glottic low-volume tumors, larynx preservation is an appropriate standard treatment option. Patients with T2N0 squamous cell carcinoma of the glottic larynx may be treated with transoral laser surgery, open partial laryngectomy or radiotherapy. Organ preservation policy in the treatment of low-volume T3 glottic cancer follows the two last methods. The goals of treatment are curing and laryngeal function preservation: breathing, swallowing and optimal voice quality.

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Additional goals include minimizing the risk of serious complications and cost effectiveness. However, laser resection of larger tumors will probably result in better outcomes. The rates of local control and survival are comparable for open partial laryngectomy and radiotherapy [1]. One of the most important issues is an easy access to the particular treatment method. Whereas, for organization reasons, radiotherapy or radiochemotherapy could be administered in 2-month time and targeted therapies are definitely too expensive, supracricoid partial laryngectomy remains a reasonable alternative for patients with T2–T3 glottic cancer. The SCL procedure is based on the preservation of the cricoid cartilage, the hyoid bone, and at least one functional cricoarytenoid unit (arytenoid cartilage, cricoid cartilage, cricoarytenoid musculature, recurrent laryngeal nerve, and superior laryngeal nerve). This structure must be free from tumor invasion. This is necessary to preserve the airway and the laryngeal sphincteric function, and to avoid a permanent tracheotomy. A thorough application of the indication is the basis of functional and oncological success in this kind of surgery.

Aim of this study is to evaluate the oncological results of supracricoid partial laryngectomy as a treatment for selected glottic carcinoma and to determine the different prognostic factors that may influence local control and survival. The additional concern is the length of hospitalisation and total hospital costs.

Material

Material include 145 patients treated in academic tertiary referral medical center: Department of Otolaryngology, Poznań University of Medical Sciences in the period of January 2000–December 2007 due to cancer of the larynx.

The age of the analyzed group of patients ranged from 20 to 79, with mean age 56.5 for 35 men and 25 women. All of the patients had biopsy proven squamous cell carcinoma. Of the 145 patients, 82 had glottic cancer and 63 had supraglottic cancer. The patients were staged according to the 2003 edition of the TNM classification established by the AJCC. The pathological TNM classification was additionally taken into consideration. Patient characteristics and the analysis of locoregional advancement were shown in Tables 1, 2.

Methods

There were four techniques of larynx reconstructive surgery applied in the presented group. The type of supracricoid partial laryngectomy was based on tumor localization

Table 1 Patient characteristics

Criteria	Patients
Total no.	145
Age	20–79
Radiotherapy	
Preoperative	0
Postoperative	5

Table 2 Locoregional advancement

Primary tumor staging	
T2	115
T3	30
Primary tumor subsite	
Glottic	82
Supraglottic	63

and extension. Patient evaluation consisted of a complete clinical history and physical examination with emphasis on local tumor advancement (videolaryngoscopy, CT, indirect laryngoscopy, microlaryngoscopy according to Kleinsasser) and neck assessment (B-mode ultrasonography with 7 MHz linear probe). All patients underwent chest radiograph. All patients were treated by means of supracricoid partial laryngectomy. Four patients underwent cricohyoidopexy, 57 cricohyoidoepiglottopexy, 65 reconstruction according to Calero, and 19 according to Sedlacek-Tucker. We performed 21 unilateral selective neck dissections and none bilateral. A nasogastric feeding tube was inserted in all patients, and removed in patients that regained proper swallowing.

The indications and contraindication for particular techniques are as follows.

Indications to supracricoid laryngectomy with CHEP

- glottic tumors classified as T2 due to tumor extension to the ventricle, false vocal cord, petiole of epiglottis, anterior aspect of the arytenoid cartilage, and/or impaired true vocal cord,
- glottic tumors classified as T3 due to fixation of the true vocal cord without fixation of the arytenoid cartilage.

With CHP—transglottic and supraglottic tumors classified as T2 not amenable to supraglottic partial laryngectomy due to ventricle invasion, glottis extension and/or impaired motion of the true vocal cord.

- transglottic and supraglottic tumors classified as T3 due to true vocal cord fixation and/or preepiglottic space invasion but without fixation of the arytenoid cartilage,
- glottic tumors originating from the anterior commissure with preepiglottic space invasion classified as T3.

Table 3 TNM classification for supracricoid laryngectomies

cTNM	CHP	CHEP	LC	LS-T	pTNM	CHP	CHEP	LC	LS-T
T2N0	0	33	63	15	T2N0	0	30	56	12
T2N1	0	1	2	1	T2N1	0	1	2	1
T2N2	0	0	0	0	T2N2	0	0	0	0
T3N0	3	23	0	2	T3N0	3	23	5	4
T3N1	1	0	0	1	T3N1	0	1	0	0
					T4N0	0	2	0	1
					T4N1	1	0	0	1

CHP cricohyoidopexy, CHEP cricohyoidoepiglottopexy, LC laryngectomy with reconstruction according to Calero, LS-T laryngectomy with reconstruction according to Sedlacek-Tucker

Table 4 Final pathology

Squamous cell carcinoma	145
Decannulation	135
Selective neck dissection	
Unilateral	21
Bilateral	–

Indication to transglottic laryngectomy according to Calero Glottic space carcinoma extending on both sides with fixation of one vocal cord and limiting vocal cord movement.

Indication to transglottic laryngectomy according to Sedlacek-Tucker Glottic space carcinoma extending on one side with fixation of vocal cord and infiltration of the anterior commissure.

Major contraindication to any reconstructive laryngectomy include:

- Arytenoid cartilage fixation
- Infraglottic extent of tumor reaching the upper border of cricoid cartilage
- Cricoid cartilage invasion
- Invasion of outer perichondrium of the thyroid cartilage
- Hyoid bone invasion
- Major preepiglottic space invasion presenting clinically with bulging vallecula and/or bulbing thyrohyoid membrane
- Extralaryngeal spread of tumor

Results

The analysis of locoregional advancement of the examined group is shown in Table 3.

Only four patients were qualified for the CHP technique. This choice was not preferred because of severe side effects including serious swallowing problems and low possibility of successful decannulation, so these patients were sent to primary radiotherapy (Table 4).

We took into consideration, the oncological and functional results.

Histopathological examination of the operating specimen revealed presence of dysplasia or invasive carcinoma at the margins or less than 5 mm from the edge of the resection (close margin) in 16 cases.

The metastases on the neck were found in 5 cases, predominantly in the level II and III. Metastasis was found in one patient that had undergone CHP, Sedlacek-Tucker, and Calero, respectively.

The decision to use adjuvant radiotherapy was based on the presence of invasive carcinoma at the resection margin and on the presence of multiple positive neck nodes or extracapsular spread of the disease. Five patients received postoperative radiotherapy. There were 11 cases (7.58%) of locoregional recurrences: 6 cases at the primary site and 5 cases at the neck lymph node. Total laryngectomy due to local recurrences was performed in every case. In coincidence of neck metastases, radical neck dissections were performed. One patient died of laryngeal cancer due to local recurrence. None of the patients died due to neck metastases. One died due to pulmonary metastases, three died due to perioperative complications (2 haemorrhagia, 1 pulmonary embolism), four patients died of causes not related to laryngeal cancer. In four patients, a second primary tumor was observed. In one case, the tumor involved the base of the tongue, in one the tonsil, in one the palate.

The Kaplan–Meier survival curves in a group of patients showed a probability of 3-year survival rate 93.44%, and a probability of 5-year survival rate 92.62% (Fig. 1).

Influence of prognostic factor on oncological result We performed univariate and multivariate statistical analysis of different prognostic factors in terms of local and survival in our 145 patients treated with supracricoid and transglottic laryngectomy.

In our group the mean and median length of stay were, respectively, 21–31 days.

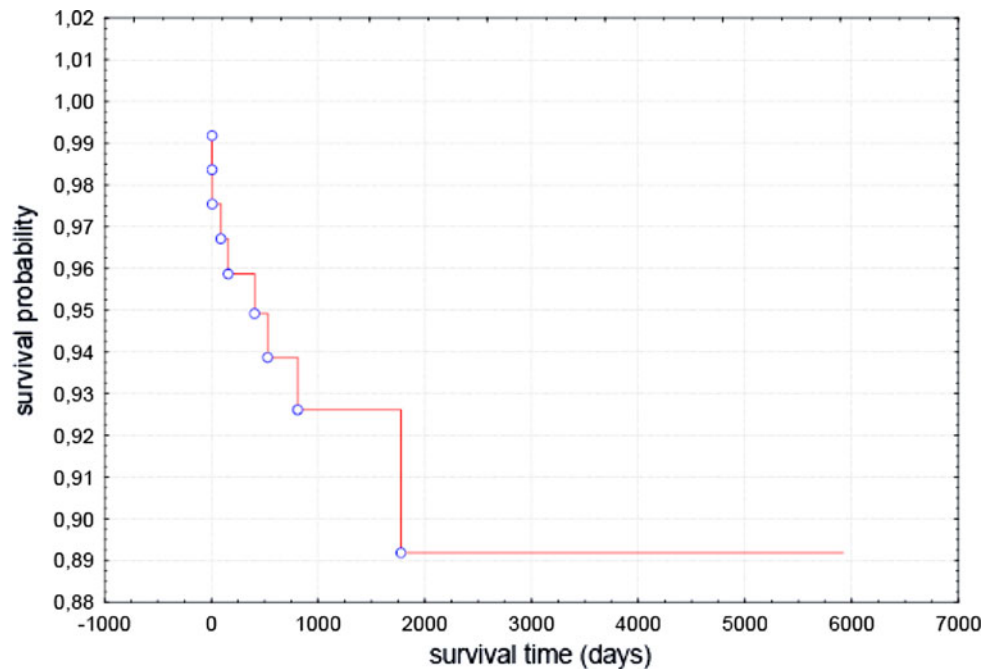
The most often reason of prolonged hospitalization was difficulty in rehabilitation of swallowing, mostly after supracricoid laryngectomy with CHP or CHP

Healing Immediate postoperative complications included anterior neck abscess, and persistent arytenoid edema. Persistent arytenoid edema was successfully managed with steroids in 25 cases, requiring laser vaporization in 19 cases. Anterior neck abscess were treated with prolonged antibiotic therapy.

Decannulation In our examined group 135 patients were decannulated. Retracheotomy was performed in 27 patients because of arytenoid cartilage edema and granulation tissue in the pexy region. The mean decannulation time was 9.28 days. 17 patients had still tracheostomies.

Swallowing rehabilitation Usually we start swallowing rehabilitation 14 days after surgery with food of a soft

Fig. 1 Kaplan–Meier survival curves



consistency. Successful deglutition by the first postoperative month was achieved in 61.37%. Temporary grade 1–2 aspiration, according to the scale used by Pearson and Leipzig, occurred in 21.37%. Pneumonia due to aspiration (grade 3) occurred in 17.24% of cases. Gastrostomy because of grade 3 aspiration was necessary in one patient. One year after surgery all our patients had obtained normal deglutition without aspiration or weight loss.

Discussion

All patients with T1 and T2 laryngeal cancer should be treated with the intent to preserve the larynx [2, 3]. In T3 glottic low-volume tumors, larynx preservation is one of the treatment options. Limited stage laryngeal cancer constitutes a wide spectrum of disease. Radiation therapy is preferred by many clinicians for the treatment of superficial tumors with preserved cord mobility, although local control rates are better in cases with anterior commissural involvement and high volume of the tumor. Supracricoid partial laryngectomy remains a reasonable alternative for patients with T2–T3 glottic cancer.

Organ preservation in larynx cancer treatment is one of the most important goals. The partial procedures, developed since the sixties, were the mile stones in larynx surgery [4–6]. Supracricoid laryngectomy is one of the treatment options to the patients with selected laryngeal cancer with hope of organ preservation. The goal of this procedure is to preserve physiological speech, swallowing, and respiration without permanent tracheostomy. The indi-

cations, technique and value of supracricoid laryngectomy with cricohyoidopexy, a partial laryngeal procedure for glottic and selected supraglottic and transglottic carcinomas, are well known. However, non-surgical approaches gain the advantage in quality of life scores.

According to Brasnu [7] supracricoid laryngectomy with CHP is indicated for selected transglottic tumors classified as T2 with invasion of the floor of the ventricle and glottis extension and/or impaired motion of the true vocal cord, selected transglottic and supraglottic tumors T3 in TNM classification with vocal cord fixation and/or preepiglottic space invasion, selected transglottic and supraglottic tumors T4 without extension to thyroid perichondrium, and selected glottic tumors with infiltration to the anterior commissure and preepiglottic spaces.

According to the literature, the supracricoid laryngectomy has more extensive indications compared with the other conservative techniques, selected T3 transglottic carcinoma caused by vocal cord fixation and/or limited preepiglottic space invasion, without invasion of the arytenoids cartilage according to Laccourreye et al., and Brasnu et al., and transglottic carcinoma invading the thyroid cartilage [4, 5, 7].

According to P. Laudadio [8], the invasion of the anterior commissure with full thickness invasion or even extracartilaginous spread of the thyroid cartilage itself is not a contraindication to supracricoid laryngectomy, as the compartment is totally resected allowing oncologically safe margins.

Overall cost of laryngeal preservation strategy (open partial laryngectomy) requires a few days hospitalization

and results in poorer voice quality compared with either laser resection or radiotherapy, although there are inconveniences associated with a 5 to 6-week course of radiotherapy [9].

There is no data directly concerned with the length of hospital stay in patients after supracricoid reconstructive partial laryngectomy, but the predictors of prolonged stay after surgery in head and neck cancer patients are well known: older age, poor functional status, history of alcohol abuse, chronic obstructive pulmonary disease and diabetes mellitus. In our group the mean and median length of stay were, respectively, 21 days and the most common reason of prolonged hospitalization was difficulties in swallowing rehabilitation, mostly observed after supracricoid laryngectomy with CHEP or CHP.

In most oncological centers, the cost of radiotherapy is lower than for partial surgery. Cost of the transoral laser is similar to the cost of radiotherapy but partial open laryngectomy is significantly more expensive. The approximate cost of RT (35 sessions) is 1,890€ while the cost of partial laryngectomy is about 5,372€ for preoperative study, surgery and 21 days hospitalization, including an intensive care unit [10]. RT had a local control rate of 79%, which increased to 90% with salvage surgery and high larynx preservation rate of 84%; partial laryngectomy had a better initial local control rate of 84%, which increased to 88% with salvage surgery [9]. In the Netherlands nearly all patients were offered radiotherapy and the mean costs of the treatment for patients with T2 and T3 carcinoma were amounted to 8,037 and 12,765€, respectively.

Several options are available to treat laryngeal cancer. Owing to the functional and social importance of the larynx, efforts must be made to preserve its function whenever possible. Several approaches can be used: partial laryngectomy (open or endoscopic) or radiotherapy (alone or combined with chemotherapy). However, medical approaches with targeted treatments, surgical options, and radiotherapy modalities, especially in T2 and T3 glottic cancer, should have clear inclusion criteria and be better selected for the proper therapy option. It definitely needs more clinical trials.

Conflict of interest The authors declare that they have no conflict of interest.

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